REPORT
Agricultural transformation model adapting to climate change in the Mekong Delta
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SUMMARY

The Research Report on the ‘Agricultural transformation model adapting to climate change in the Mekong Delta’ was carried out within the framework of the project ‘Engaging the private sector in Viet Nam in resilience building against compounding risks’ with the collaboration of the Connecting Business Initiative (CBi), the United Nations Development Programme (UNDP) and the Viet Nam Chamber of Commerce and Industry (VCCI). This project is financially supported by CBi and the Green Climate Fund-financed Coastal Resilience Project of UNDP. It aims to support the business community to connect management networks to respond to disasters, climate change and epidemics. Accordingly, CBi will continue to support Viet Nam to further strengthen its business network in building resilience against interconnected risks.

The Research Report, developed by the Can Tho Branch of VCCI, uses secondary data sources to present the current status and challenges faced by the agricultural sector in the Mekong Delta (MD). In addition, the Report also consulted leading enterprises in the sector on the production models being applied. Since then, the Report has made appropriate recommendations to shift the agricultural production model of the MD in the direction of “favorable nature”.

At the present time, Viet Nam is facing a number of climate change-related challenges, with the increase in frequency and intensity of many extreme climatic phenomena. Viet Nam is also one of the most vulnerable countries in the world to the impacts of climate change, and many international studies have shown that Viet Nam is among the 10 countries most negatively affected by climate change. With an estimated average annual loss of up to 1.5 percent of Gross Domestic Product, climate change has adverse effects on macro-economic achievements, institutional reform and environmental sustainability goals in Viet Nam.

In particular, among the seven economic regions of Viet Nam, the MD is the most heavily affected by climate change. Climate change negatively impacts the agricultural sector in the region; in particular, drought and saltwater intrusion have become more frequent in recent years. Currently, with over 2.4 million hectares of agricultural land and nearly 700,000 hectares of water surface for aquaculture, the MD has contributed 54 percent of rice yields, providing 90 percent of rice production for exports; 70 percent
of seafood (nearly 100 percent of pangasius exports; 80 percent of shrimp production accounts for 60 percent of the Viet Nam’s shrimp export turnover); and 36.5 percent of the country’s fruit production. Climate change has destructive effects on agricultural production, including increased production costs, reduced crop and livestock productivity, lost financial resources, reduced product quality and lost agricultural land.

Additionally, climate change also affects seasonality and by extension, agricultural livelihoods, meaning that some farmers will likely have to change (or trade off) livelihoods in the MD. With an agriculture-dominant economic structure, the MD is one of the regions most heavily affected by climate change in Viet Nam.

Currently, the MD is facing major external challenges beyond climate change, such as drought and salinity, landslides, flooding, hydropower exploitation activities in the upper Mekong River, the over-exploitation of groundwater, flood control activities and unsustainable agricultural practices in the MD and increasing environmental pollution. At the same time, there are internal problems such as weak infrastructure, fragmented and localized irrigation system planning, low number and competitiveness of enterprises, limited quality of human resources, low labor productivity and increased migration, all of which are direct impacts on agriculture that the MD is faced with.

In addition to the above factors, the MD’s agriculture is also facing a plethora of additional problems, including the small scale of agricultural production, as well as its fragmented nature and low added value. Exported products are mainly raw, low value and unsustainable products. Renovating the form of production organization in agriculture is taking place gradually, mainly in the household economy; the majority of enterprises and cooperatives remain small in scale, with limited operational efficiency.

These increasingly serious factors act simultaneously and exacerbate one other, adversely impacting the MD’s agriculture. Currently, although localities still have policies in place to develop and respond to climate change, these models need to be perfected in order to be effective. Implementing agricultural transformation needs to focus on the role of farmers linked to the State (policy support), scientists (technical assistance) and entrepreneurs (market support). It is critically important to promote close coordination and coherence between actors to improve the value, competitiveness and position of Vietnamese agricultural products in the international market. This improves
the income and quality of life of farmers, and is one of the important tasks in the process of agricultural transformation in the MD in the coming time.

Given the above challenges, the MD’s agriculture needs to transform in the direction of a modern industry associated with the market economy and international integration. In order to achieve this, planning production and forecasting must be in line with the market demand; a connection must be created between agricultural production and processing industries among farmers, entrepreneurs and scientists; and the application and transfer of techniques and technologies to agriculture must be strengthened. In addition, it is necessary to support enterprises in the agricultural sector to replicate successful production models. Especially, the leading enterprises of the sector have the role of leading and supporting farmers in transforming agricultural models. In order for the transformation of agricultural models adapting to climate change to be smooth and effective, the following transformations are required:

**Changing vision**

A change in the vision of agricultural production towards the market in order to both ensure food security needs and increase the value of agricultural products is urgently needed. Resolution 120 has identified the following three pillars of agricultural production in the MD in order of priority: fisheries, fruits and rice. This helps to readjust the structure of agricultural development in ecological regions. Thereby, agriculture in the MD is expanding production scale in the direction of increasing the value of agricultural products, and ensures the domestic and export agricultural supply markets.

Realizing the agricultural transformation vision in the MD requires the implementation of a combination of solutions, such as (i) scientific–engineering solutions and adaptive farming systems, (ii) small work solutions to reduce investment costs and flexible management, (iii) suitable conversion of land use purposes, and (iv) investments in larger works to manage risks and accept some sacrifices of environmental and ecological factors. This is entirely favorable, reducing violent interference with nature and avoiding the possibility of regret later due to the uncertain factors of nature.

**Transforming production models**

The “One Commune One Product” (OCOP) model is being widely applied in localities. Despite many limitations, the OCOP model is also bringing some positive
changes. Accordingly, agricultural products are processed into products and services that are developed based on the comparative advantages of each locality, have added value and positively impact the local community. Products labeled ‘OCOP’ can register an exclusive trademark, increasing competition in the market. Market information and consumer reflection, in addition to updated weather factors, help farmers make informed farming decisions for each of their seasons.

This model allows farmers to become more deeply involved in the value chain of agricultural products, taking the initiative in capital and technology for the transition. This model of production - processing - supply chain is being applied by a number of large corporations including but not limited to Vinamit, Vinamilk and My Lan, and has been found to operate stably.

Transforming institutions

For a long time, the linkage of the four actors (the State, entrepreneurs, scientists and farmers), or lack thereof, has played an important role in Viet Nam’s agriculture in general and the MD in particular. Thus, it is necessary to build an institutional framework to ensure compliance with the implementation of regulations between businesses and farmers to protect the interests of the parties. The coordination among the actors in the four-house linkage helps to remove the institutional problems that govern the production, purchasing and processing of agricultural products, and to solve the “rescue” problem that is common in the MD due to not being able to find a market for export. If this relationship is strengthened, farmers will actively decide to invest in production because they will know that their products will have a profit and consumption in the market.

In addition, the MD should also be prioritized for more budget allocation, commensurate with the population size, contribution level and challenges, as well as socio-economic development requirements of the region. In budget allocation for the MD, increasing investment capital for infrastructure, especially transportation infrastructure, is crucial. This stems from the fact that the quality of transportation and logistics infrastructure in the MD is among the lowest in the country.

Transforming Science and Technology

Promoting high-tech agriculture is a key factor in the implementation of
agricultural transformation in the MD. This is a production method that applies advanced technology (such as mechanization, automation, computerization and so on); environmentally friendly green production technology; reduced consumption of natural resources; and reduced greenhouse gas emissions. Under this approach, all agricultural products are preserved cleanly and processed in compliance with safety standards, increasing the value of agricultural products with quality recognition.

Implementing the mechanization and modernization of agriculture requires concerted efforts by actors in the four-house linkage. In addition, there should be support from donors (such as non-governmental organizations and civil society organizations) and banks (supporting lending, credit, incentive programs and so on). In agricultural production, it is necessary to integrate the following six sectors: mechanization-automatic; meteorology-hydrology; biotechnology, chemistry; preservation and processing of agricultural products; and finance, business administration and information technology.

In general, agricultural transformation models need to focus on the value of agricultural products and food safety, based on natural and environmental factors in the spirit of “favorable nature”. This helps reduce regretful decisions and lead to greater economic, environmental and social performance. Besides some orientations and typical agricultural models, the study also proposes some specific solutions that CBi can support in the coming time to move towards sustainable agriculture.

- The development of a convenient and flexible land use conversion mechanism that has some preferential policies on land, income tax and interest.
- Planning for regional linkages and creating opportunities for enterprises/cooperatives to produce and do business in the direction of chain linkage as the circular economy model.
- Investing in infrastructure for electricity, water, transportation and information technology to support and attract investments in agricultural projects on climate change adaptation.
- Attracting talent and retaining a young workforce to develop the MD. Training human resources to serve the transition to high-tech agriculture.
■ Co-ordinating with the Mekong Delta Resilient Business Network to provide information on climate change for businesses, as well as update and support the application of climate change adaptation production methods.

■ Participating in and supporting the implementation of the Annual Economic Report Mekong Delta in order to conduct in-depth research and assessments on climate change adaptation in the region to have a basis for promoting appropriate policies towards the sustainable development of the MD.

■ Actively integrating information on risks of saltwater intrusion and drought into agricultural, forestry and fishery development plans in ecological sub-regions.

■ Building and operating a system of environmental monitoring, warming for irrigation water in estuaries and canals to monitor saline intrusion and salinity level to inform people and cooperatives.

■ Organizing and engaging farmers in production chains through cooperatives. This is an appropriate model in the context of small farming areas and the lack of investment resources in the MD.

■ Supporting cooperatives and farmer households to develop models of circular economy on agriculture and ecological agriculture in rice and fruit production, animal husbandry and aquaculture.

■ Building large-scale agricultural production areas associated with the application of science and technology to adapt to climate change, applying innovative and creative solutions to improve product quality and support deep processing.
Chapter I

I. OVERVIEW OF THE MEKONG DELTA'S AGRICULTURE
Viet Nam is facing a number of challenges caused by climate change, with the increase of many extreme climatic phenomena. Viet Nam is also one of the most vulnerable countries in the world to the impacts of climate change, and many international studies have shown that Viet Nam is among the top 10 countries most negatively affected by climate change. With an average annual loss estimated at up to 1.5 percent of Gross Domestic Product (GDP), climate change is undermining macroeconomic achievements and institutional reform, and hindering the achievement of environmental sustainability goals in Viet Nam.

The MD is the region most heavily affected by climate change among the seven economic regions of Viet Nam. Climate change has significantly impacted the agricultural industry in the region, especially due to drought and saltwater intrusion in recent years. Currently, with over 2.4 million hectares of agricultural land and nearly 700,000 hectares of water surface for aquaculture, the MD has contributed 54 percent of rice yields, providing 90 percent of rice production for export; 70 percent of seafood (nearly 100 percent of pangasius exports; 80 percent of shrimp production accounts for 60 percent of the country’s shrimp export turnover); and 36.5 percent of the country’s fruit production.

![Figure 1: GRDP (Gross Regional Domestic Product) structure of the Mekong Delta over the years](source: Provincial Statistical Yearbooks)

As the regional economic structure, the agricultural industry also accounts for a high proportion, remaining at more than 30 percent. In the period of 2017-2020, the
proportion of agriculture, forestry, and fisheries tends to decrease gradually, from 33 percent in 2017 to 31 percent in 2020. However, by 2021, it has ended its decline and increased again to 32 percent. Over the two years of 2020 and 2021, the COVID-19 pandemic affected economic growth in all three regions of the MD’s provinces, especially in the industry, construction and service sectors. Accordingly, the agricultural sector is still the strength of the region and is less affected than other sectors. The provinces that are relatively less affected and maintained their growth in 2021 are those that have formed a cluster of seafood processing industries and manufacturing industries, and that have strong export markets and are less dependent on the tourism service industry.

**Key industries in the Mekong Delta**

The MD is a land favored by nature, with the main economic pillar coming from the agricultural industry. Based on the advantages of the region, the agricultural sector, in particular rice and seafood, is still considered a key industry in the economic development of the MD.

**Rice**

The MD is currently the most fertile agricultural production area in the country and is becoming the focus of attention of investors. Accordingly, the rice growing area of the region is always ranked first in the country, accounting for 52 percent of that of the country, on average. The rice export volume of the MD also accounts for 90 percent of the country’s total rice exports.
Figure 2: Area and production of rice in the Mekong Delta

Source: Provincial Statistical Yearbooks

The rice area of the MD has gradually decreased over the years, from more than 4,000 hectares in 2017 to nearly 3,900 hectares in 2021, corresponding to a decrease of nearly 7 percent. Although the area decreased, the production of rice in the region increased significantly. After the decline in 2019 and 2020, in 2021, rice production increased again and is close to returning to the old peak in 2018.

Figure 3: Turnover and value of rice exports of Viet Nam 2017-2021

Source: Viet Nam Food Association

According to statistics of the Viet Nam Food Association (VFA), Viet Nam’s rice exports in the period of 2017-2020 increased by nearly 7 percent, while the export value increased by 22 percent. If calculating the average annual growth rate during this period, export volume increased by nearly 1.2 percent, while export value increased by nearly 4.4 percent. This shows a significant improvement in the export price of rice thanks to the improved quality of rice, the change in the rice industry’s structure of production and export processing of high-quality rice varieties.

Regarding the seed issue, the rice industry in the MD has constantly applied improved plant varieties, from rice varieties with low yields of only two to three tons/hectare to high-quality ones with yields of six to eight tons/hectare. The rice yield of the region in most years is higher than the national average. Thanks to the change of seasons from one to two crops/year to three main rice crops/year, along with the renovation of rice variety structure and production processes towards intensive farming
to increase productivity, annual rice yields for each crop and the region as a whole increased gradually over the years. Major contributors to the region’s rice production are the three provinces of Kien Giang, An Giang and Dong Thap; the rice output of these three localities accounts for nearly 50 percent of the entire region’s rice production.

Not only has the output increased rapidly, but the quality of rice is increasingly improving, with specialty rice such as IR64, OM1490, OM2031, VND95-20, MTC250, IR62032, Cho Dao and Jasmine. In particular, the MD has recently bred ST rice, especially ST25, which was honored as the best rice in the world in 2019. This is considered a good and respectful signal for the MD’s rice industry, contributing to creating competitive advantages for Viet Nam’s rice industry.

In addition, the rice industry is also facing challenges, such as excess supply, unstable output prices, low profits, and small farming area per household. The fragmentation of arable land makes it difficult to apply scientific and technical advances, leading to high input costs and saturated productivity. In addition, under the pressure of yield, farmers have abused chemical fertilizers for a long time, leading to the invasion of pests and diseases, thus forcing the application of pesticides. The three-crop rice cultivation also causes soil quality deterioration and nutrient depletion.

At the present time, the MD has favorable nature conditions for cultivation, with a large area of arable land, which is alluvialized by the Mekong River. However, the construction of dikes to prevent floods and three-crop rice cultivation shows that there is not much potential for the development of this industry, resulting in the deterioration of soil quality and nutrient erosion from the soil. Chemical farming practices also contribute to land degradation and pollution.

**Seafood**

Besides rice, seafood is also one of the key industries of the MD. With a coastline of about 780 kilometers, 22 large and small estuaries and an interlaced system of canals and rivers, the MD has favorable conditions for aquaculture. The total fishery output (including aquaculture and fishing) of the MD region always accounts for over 50 percent of the total fishery output of the country every year. In 2020, the total fishery production of the MD region reached 4,698 thousand tons, accounting for 55 percent of the total seafood production of the country.
In 2021, seafood exports at the end of the year reached the target of US$8.9 billion, up 6 percent compared to 2020. Of this, shrimp brought in nearly $3.9 billion, up four percent, pangasius accelerated sharply in the last two months of the year and reached the target with over $1.6 billion, up 8.4 percent; and seafood exports reached $3.4 billion, up seven percent.
The average growth rate of total seafood production of the MD in the period of 2015-2020 is 4.9%. In which, An Giang (8%), Tien Giang (7%) and Soc Trang (7%) are the three provinces with the highest average growth rate of total seafood production in the region in the period of 2015-2020. Particularly in 2020, Kien Giang is the province with the highest total seafood production in the MD, with 819 thousand tons, accounting for 17% of the total production of the whole region.

Fishery in the MD develops towards focusing on two main industries: brackish water shrimp and pangasius. Both of these industries have a long enough history and conditions to develop into clusters. However, the operating characteristics as well as the advantages and disadvantages of each industry are different. If the brackish water shrimp industry is entering the beginning of development, pangasius one is starting to have a state of saturation. Both industries are export-oriented and face difficulties related to the supply and demand situation. In the current difficult context of international trade, it is necessary to recognize and evaluate competitiveness to find solutions to develop the seafood industry.

**Brackish water shrimp**

In the last 12 years (2008-2019), production of brackish water shrimp (black tiger shrimp and whiteleg shrimp) has grown very rapidly due to increased export demand. As of 2008, the brackish water shrimp farming area in the MD is nearly 540 thousand hectares (accounting for 89 percent of the total farming area in the country), mainly raising black tiger shrimp with an output of about 160 thousand tons. However, by 2010, the structure changed towards increasing the area and production of whiteleg shrimp instead of black tiger shrimp. Viet Nam’s shrimp exports in 2021 reached $3.88 billion, up four percent.¹

According to the Viet Nam Association of Seafood Exporters and Producers (VASEP), including in 2019, the shrimp raising area has increased to 720 thousand hectares, with an output of 750 thousand tons. Of this, the output of black tiger shrimp is estimated at 270 thousand tons and whiteleg shrimp is 480 thousand tons. Production forms also changed from extensive raising and improved extensive raising to intensive,

semi-intensive and super-intensive raising. In general, in the past 10 years, the area and output of black tiger shrimp raising tended to increase slightly or level off, while the area of whiteleg shrimp farming tended to increase rapidly and was higher than that of black tiger shrimp.

Along with the increase in production after the global financial crisis, the number of seafood processing and export enterprises also increased to meet export demand. As of 2019, according to VASEP, there are more than 600 seafood processing and export enterprises exporting to more than 170 markets, creating jobs for about five million workers. Large enterprises in seafood processing and export are concentrated in the MD (over 50 percent of the total number of seafood processing and export enterprises). In 2019, the top 10 largest enterprises in Viet Nam that exported shrimp were Minh Phu Seafood Corp., Minh Phu - Hau Giang Seafood Joint Stock Company, Stapimex, Fimex VN, Viet Nam Clean Seafood Corp., Thuan Phuoc Corp, Trang Khanh Seafood Co., Ltd, Tai Kim Anh Seafood Joint Stock Corp., Southern Shrimp Joint Stock Corp. and Ut Xi Aquatic Products Processing Corp. They account for 16.8 percent of total seafood exports and 42.9 percent of the country’s total shrimp exports.²

² VASEP, 2020


Chapter I – Key Industries of the Mekong Delta’s Agriculture

**Pangasius**

In the past 10 years, pangasius has been a key export product of Viet Nam’s seafood industry, contributing to the growth of export turnover of the industry in particular, and the country in general. Besides favorable nature conditions, the technology is not overly difficult, allowing for pangasius farming to develop quite strongly. Although the development of pangasius farming area in the MD has many ups and downs, the general trend is outstanding growth. Specifically, if in 2003 the area of pangasius farming in the MD was 2,792 hectares, in 2010 this figure was 5,400 hectares, with an output of 659 thousand tons. By 2019, it was 6,600 hectares, with an output of about 1.42 million tons of raw pangasius.³ Viet Nam’s pangasius export in 2021 also far exceeded the forecast, with over $1.6 billion, up 10 percent.⁴

The development of raising area and output leads to an increase in the number of seafood processing enterprises and export markets for pangasius. As of 2019, there are 125 enterprises participating in the export of pangasius to China and Hong Kong City; 30 enterprises exporting to the United States (US); and 50 enterprises exporting to the European Union (EU). If in 2006, Vietnamese pangasius was only exported to 65 countries, by 2019 this number was 131, more than doubling. The EU and the US were the two main markets of Viet Nam’s pangasius imports in 2010, adding China and Hong Kong City in 2019.

**Effects of climate change**

According to the survey results in 2020 of the Institute of Policy and Strategy for Agriculture and Rural Development, 80 percent of agricultural cooperatives surveyed said that climate change has occurred in the area in the past five years, including saline intrusion, drought and extreme weather (thunderstorms, heavy rains and floods). More than 96 percent of cooperatives mentioned that climate change negatively affected their agricultural production, including by increasing production costs, reducing crop and livestock productivity, losing money, reducing product quality and resulting in the loss of agricultural land.

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³ VASEP, 2011, 2020
To expand, climate change also increased production costs across all crop and fishery groups by an average of about 26 percent. More specifically, saline intrusion increased production costs by 29.1 percent, drought by 27.6 percent, extreme weather by 22.7 percent and other phenomena by 23.1 percent.

By type of crop and livestock, the survey results showed that climate change increased the cost of rice production by 18 percent; fruit trees by 34.5 percent; aquaculture by 36.8 percent; and other crops (vegetables) by 31.7 percent. In addition, the productivity of crops and livestock was also found to have reduced by an average of about 35 percent. Saline intrusion caused a yield reduction of 41.5 percent, drought of 35.8 percent, extreme weather of 27.9 percent and other phenomena of 28.3 percent. More specifically, fruit trees had the most yield reduction at 49.6 percent; aquatic products decreased by 43.9 percent, rice decreased by 24.9 percent and other crops decreased by 30 percent.

In addition, climate change also affects seasonality and agricultural livelihoods; in fact, several farmers in the MD are likely to have to change (or trade off) livelihoods.
II. CURRENT STATUS AND CHALLENGES OF THE MEKONG DELTA'S AGRICULTURE
1. Current status

Current status of resources

Natural resources

Each year, the MD receives a large amount of water from the Mekong River, with a total flow of up to 475 billion m$^3$ of water per year. The high water season starts from July, increasing gradually from August to September, before peaking in October and gradually decreasing in November to December. The highest water flow is 39,000-40,000 m$^3$/s on average in the rainy season, causing flooding of 1.2 to 1.9 million hectares (Le Anh Tuan et al., 2008). Flooding is a natural phenomenon that occurs every year in the MD. Meanwhile, in the dry season, the water level of the Mekong River drops very low and the average flow is only about 1,700–2,500 m$^3$/s. This causes saltwater from the sea to overflow, making more than half of the natural area saline. The reduction of arable land through urbanization is associated with the deterioration of water quality and surface water due to low floods$^5$ and groundwater (0.01-0.55 m/year) (Nguyen Le Duy et al., 2021), leading to increasing challenges for local people.

Infrastructure

In comparison with other regions, the road transport system within the MD connected to Ho Chi Minh City (HCMC) and the Southeast provinces is relatively limited. By the end of 2021, there were only 96 kilometers of highways connecting Long An to My Thuan (Vinh Long province), compared to more than 1,200 kilometers of national highways. In particular, although the Trung Luong-My Thuan route only recently opened to traffic, the traffic capacity is already close to the design level.$^6$ While the My Thuan–Can Tho and Can Tho–Ca Mau routes are still under planning stage. In addition, subsidence, local landslides and roadside landslides still occur frequently, causing traffic restrictions and the risk of accidents.

Regarding waterways, the MD does not yet have an international port or a true deep-water port. According to research by the World Bank, Viet Nam’s logistics costs

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are equivalent to 20.9 percent of GDP, of which transportation costs account for about 59 percent. Currently, the MD has an annual demand of exchanging goods for export of about 18 million tons. However, 70 percent of these goods must be transported to major ports in HCMC and Cai Mep Port (Ba Ria - Vung Tau). These make transport costs for enterprises 10-20 percent higher, depending on each route.

According to the Annual Report 2021 of Viet Nam Electricity (EVN, 2021), currently, the national power network with 500KV, 220KV and 110KV lines has connected regions in Viet Nam. The target of rural electrification is for 100 percent of the electricity grid to reach the commune level, serving 99.3 percent of families. Up to now, almost all people in the MD have access to national electricity. At the same time, the communication system also covers almost all communes and people can access Internet services both in public and at home.

**Government investments**

In the coming time, the Government will increase investment in the MD to establish it as a key economic region in the South. Accordingly, the Ministry of Transport has developed five national specialized plans for the period of 2021-2030 with a vision to 2050 on roads, railways, maritime, inland waterways and airways, with a total investment capital of about VND 252,694 billion. Particularly, in the period of 2021-2025, about VND 50,690 billion is expected to be allocated to the MD region, accounting for 20 percent of the total investment capital of the country’s transportation industry. This funding aims to support investment in some key highway projects and projects in other specialties.

However, the allocation of public investment capital to the MD has not yet met the needs and development goals of the region. In the transport sector alone, the total investment capital for the whole region in the period of 2011-2015 was VND 67,552 billion, and only VND 65,000 billion in the period of 2016-2020. Even the plan for the period of 2021-2025 will be reduced to VND 50,690 billion. According to a report by the Ministry of Planning and Investment, during the 2021–2025 period, the total state budget investment for the whole area of the MD is about VND 388,000 billion.

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Of that, the state budget support for investment projects managed by localities in the region is about VND 266,000 billion, accounting for 68.6 percent of the total investment capital in the region, and at the same time, increasing by 20 percent relative to the period of 2016-2020. Of that capital, about VND 162,000 billion is from the local budget, accounting for more than 60 percent; about VND 82,000 billion is allocated from the government budget, accounting for about 30 percent; and the remaining less than 10 percent is foreign capital.

**Farmers’ production level**

Currently, the agricultural production scale of the MD is still small and fragmented. Exported products are mainly raw, low value and unsustainable. The form of organization of production in agriculture is still mainly household economy; the majority of enterprises and cooperatives are small in scale, with limited operational efficiency.

In addition, most farmers are resource-constrained, and many of them are elderly, lack knowledge about commodity production, lack understanding of the market economy, and mainly produce according to experience and movements. Most farmers in the MD are farming based on word of mouth or experience. The proportion of trained farmers is very small, leading to rudimentary farming techniques.

![Image: Labor level in households engaged in agro-forestry-fishery activities](source: Census of Agriculture, Forestry and Fisheries)

**Figure 6: Labor level in households engaged in agro-forestry-fishery activities**
According to the results of the census of Agriculture, Forestry and Fisheries in 2020, more than 80 percent of the members of households engaged in agro-forestry-fishery activities have not received technical training, and only about eight percent of workers have training certificates or degrees higher than primary education. This shows that increasing the education of farmers in the MD needs to be paid more attention to successfully implement agricultural transformation in the coming time. Accordingly, agricultural extension plays a particularly important role in raising the level of farmers.  

**Migration**

According to the General Statistics Office, the population of the MD in 2020 was more than 17.3 million people, virtually unchanged from 17.3 million people 10 years prior. The number of net migrants out of the MD in the last decade was nearly 1.1 million people, larger than the population of some provinces in the region and equivalent to the natural population growth of the whole region. While the MD accounts for nearly 18 percent of the country’s population, in the period of 2009-2019, the region’s urban population only increased by 403 thousand people, approximately 5.3 percent of the country's urban population growth. The urbanization rate of the whole region in 10 years only increased slightly from 22.8 percent to 25.1 percent, while the whole country increased from 29.6 percent to 34.4 percent. As a result, the urban population gap in the MD compared to the whole country is widening.

The unequal economic development between urban and rural areas is a factor leading to changes in rural society today. In the MD, young people in rural areas who have migrated to find work in industrial parks and export processing zones in big cities like HCMC and Binh Duong are increasing. The stability of income sources when working in urban areas is strongly attracting a large workforce from the countryside. In addition, the strong mechanization of agricultural farming activities has contributed significantly to the migration of rural residents as most of their jobs, mainly those of the poor, have been replaced by machines. The process of rural-urban migration has caused a number of inadequacies, including disrupting the balance in the age of rural people, 

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causing a shortage of local labor resources in the agricultural sector and increasing pressure on financial support for the elderly in rural areas due to a lack of caregivers.

**Agricultural policies in the Mekong Delta**

**Irrigation development policy**

In the past few decades, the MD has been considered the main food supplier for the country. This shaped the irrigation system to serve the policy of agricultural intensification, especially in the period of 1990-2015. These irrigation systems span tens of thousands of kilometers with irrigation systems of all levels, sea dikes and river dikes to prevent floods and salinity, sluices and dams to control water and many large and small pumping stations. To date, more than 90 percent of the arable area in the MD has been irrigated, and the process is still ongoing.

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**Figure 7: Changes in agricultural policies in the MD over the years**

*Source: Le Anh Tuan, 2022*
However, the planning of the MD irrigation system is still fragmented and is a local vision of each locality. The spontaneous and indiscriminate construction of irrigation works leads to changes in the flow of water and ecosystems in the area. This may also affect the natural ecosystems of neighboring areas or at the end of the Mekong River.

**Transforming agricultural production structure according to Resolution 120**

The Prime Minister (2017)\(^{10}\) issued Resolution No. 120/NQ-CP on “Sustainable Development of the Mekong Delta Adapting to Climate Change”. This Resolution was born in the context that the MD is facing challenges both internally and externally. The core highlight of this Resolution is the spirit of development on the basis of respecting the laws of nature, also known as “favorable nature”. The Resolution also identifies climate change adaptation as a strategic policy to help the MD reposition its development process. That is, respecting the laws of nature, in accordance with actual conditions, and avoiding violent interference with nature; choosing a model of adaptation according to nature; and environmentally friendly and sustainable development with the slogan of actively living with floods, inundation, brackish water and saltwater. Resolution 120 has identified three priority pillars in agricultural production in the MD as fisheries – fruit trees – rice.

In restructuring agricultural production, Resolution 120 focuses on changing the development mindset, shifting from a purely agricultural production mindset to an agricultural economic development one to meet the needs of the market. In addition, the Resolution focuses on shifting emphasis from quantity to quality; building new rural areas associated with strongly developing high-tech applied agriculture, organic agriculture and clean agriculture associated with value chains and brand building; and developing processing industry and supporting industry in association with agricultural economic development.

2. Challenges

Factors affecting agriculture in the Mekong Delta

Climate Change

The MD is heavily affected by weather changes and sea level rise. According to the national climate change scenarios of Viet Nam updated in 2016: under the scenario of the representative greenhouse gas concentration distribution curve Representative Concentration Pathway (RCP) 4.5 (average scenario), by the end of the 21\textsuperscript{st} century, the annual average temperature in the MD region may increase by 1.7°C to 1.9°C, and precipitation may increase by 5-15 percent. The rainfall in the rainy season increases and the rainfall in the dry season decreases, making the rainy season wetter and the dry season drier, accompanied by extreme weather conditions due to severe and frequent floods and droughts\textsuperscript{11}. Under the more extreme RCP 8.5 scenario, by the end of the 21\textsuperscript{st} century, the average annual temperature in the MD could increase by 3.0°C to 3.5°C, precipitation could increase by over 20 percent and sea level could rise from 48 cm to 106 cm.

During the period of 1986-2014, the MD region saw an increase in sea level of about 95.2 mm (average of 3.40 mm/year). Under the RCP 4.5 scenario of the national climate change scenario updated in 2016, by 2100, in the MD, the sea level is projected to rise by 55 cm on the Eastern coast and 53 cm on the Western coast. This may disrupt

\textsuperscript{11} The updated 2016 scenario shows the forecasts of higher temperature and precipitation but lower sea level rise than the 2012 scenario. The 2012 scenario forecasts an increase of 1.60 C-1.90 C in temperature and 3%-5% in precipitation with 51-66cm for Eastern coast and 54-72cm for Western coast.
the salt-fresh balance of the delta, causing salt to penetrate deeper inland, affecting the aquifers and flooding the delta.

Increasing temperature, changing rainfall patterns and sea level rise, combined with the system of hydroelectric dams and water intake works in the upper Mekong River have changed and will continue to shift the flood regime towards more extreme upstream of the MD and increased saline intrusion downstream. From 2000 to present, floods in the MD have tended to decrease, most pronouncedly in the last five years. Besides natural factors, the biggest impact is the regulation of hydropower reservoirs upstream, which reduced the flow in the flood season. The MD currently has moderate to small and even very small floods. Previously, the total flood volume into the MD was from 380-420 billion m³ and lasted until December whereas now, only this volume is about 300-320 billion m³ and almost ends in November. This situation leads to a decrease in silt and nutrients for the land, reducing natural aquatic resources and increasing saltwater intrusion downstream.

Climate change affects water levels in the basin and sea level rise has the strongest effect on salinity in the delta. In dry years, saline intrusion can be widespread in the coastal and intertidal areas of the delta, with about 35 percent of the delta having salinity levels greater than 4g/l. The MD currently has about 2.1 million hectares of plain land that is saline (accounting for 50 percent of the total area), especially in the dry season, which is from December to May. Saline intrusion is the main limiting factor for agriculture and domestic water supply in these regions.

Despite being a dynamic agricultural region with significant contributions to the national economy, the lives of farmers and fishermen in the MD are still low and precarious due to direct risks from the negative impacts of climate change and sea level rise. If the rate of greenhouse gas emissions continues to increase as rapidly as it is now or even faster, in the absence of mitigation measures, the worst-case scenario could happen. By the end of the 21st century, about two million hectares of the MD may be flooded and there could be a combination of huge floods combined with high tides, sea level rise, and delta subsidence.
Slow modernization in agriculture

The MD is still slow in modernizing the organizational form of agricultural production in order to improve productivity and product value. At the current stage, agricultural production is still focused on increasing output under the impact of prolonged ‘food security’ mission and exporting raw materials, instead of upgrading the quality and developing the agricultural economy following market direction. In the past several years, in order to apply technology to improve productivity and quality of agricultural products, localities have implemented two major policies: consolidation and exchange of plots and construction of large fields. However, as of July 1, 2020, only 66 communes in the MD carried out the consolidation and exchange of plots with an area of four thousand hectares, a very low scale in comparison with the total in the country, 790.1 thousand hectares (General Statistics Office, 2022).

Figure 8: Map of land use in the MD in 2018

Source: Chapman and Tri, 201812.

Besides, the process of land use conversion is quite slow. The MD is mostly agricultural land with three main types of farming, namely rice cultivation, aquaculture and fruit and vegetable crops. From 2000 until now, the biggest change has been in the use of agricultural land, especially for rice cultivation. In 2000, the rice growing area of the whole region reached 3,945.8 thousand hectares per year, mainly in two crops.

12 Alex Chapman and Van Pham Dang Tri (2018). Climate change is triggering a migrant crisis in Vietnam.
According to research by Nguyen Hoang Dan et al. (2015),\textsuperscript{13} the area of rice land in the MD in the period of 2005-2014 increased by 4.4 thousand hectares compared to the previous period. Currently, with the spirit of Resolution 120, localities tend to convert inefficient or low-value rice land to fruit trees or aquaculture, or to a rice-shrimp model in coastal areas. In the period of 2017-2020, nearly 400,000 hectares of rice land have been converted to other types of farming.

\textit{The decline in freshwater flow}

The hydropower systems in the Mekong River, especially the hydroelectric system in the Chinese territory, have had many impacts on the flow of the Mekong River. The construction of reservoirs to operate these hydroelectric systems has accumulated a huge amount of water, significantly reducing river water levels and disrupting the downstream riverine ecosystems downstream.\textsuperscript{14} In addition, the dual effects of seasonal climate change (changes in precipitation and temperature) in the downstream area, combined with the accumulation of water by hydropower dams in the upstream area, have affected to the Mekong River flow. Located downstream, the MD has always suffered from these impacts and is becoming more and more serious.\textsuperscript{15}

Besides hydropower, countries in the basin are also planning to use water in the Mekong River on a large scale for irrigation purposes and to expand agricultural land. The promotion of hydroelectricity development and the use of water for agricultural development in the upstream will reduce water flow and alluvial content in the water downstream of the MD, significantly changing the flow regime in the dry season compared to natural conditions.

According to a study by the Mekong River Commission (MRC),\textsuperscript{16} before having hydropower dams, the total amount of alluvium supplied annually to the MD was 160 million tons, of which 60 percent came from upstream (China); 30 percent from

tributaries; and 10 percent from the Sekong, Sesan and Srepok River systems. Currently, the amount of alluvium supplied to the MD has decreased significantly due to the retention of reservoirs.\textsuperscript{17} Alluvium depletion has caused riverbank erosion and increased production costs for farmers.

![Figure 9: Alluvial momentum analysis](image)

Source: Model of Nechad and n.n.k (2010)

Computational model of alluvium in the river basin of Nechad (2010)\textsuperscript{19} and adjusted in 2016 showed that in the period 1988–2010, the amount of alluvium along the


\textsuperscript{18} averaged from the November of the previous year to the February of the following year, unit: mg/m\textsuperscript{3}

Mekong River basin reached a maximum of 55 mg/m³ but in the period 2010-2020, the amount of silt decreased significantly (to 48 mg/m³). It is estimated that the amount of alluvium along the Mekong River (according to the Hau River tributary), stretching from the area adjacent to Cambodia downstream through An Giang, Can Tho, Hau Giang and Soc Trang, in 2010 averaged about 1,250 tons. However, by 2020, the amount of alluvium was only expected to be about 1,000-1,090 tons.

According to a report by the State Audit, the amount of Mekong River water from upstream to the MD in 2020 will decrease by 157 billion m³ compared to 2011. As well, the amount of sediment and sand in 2020 was also expected to decrease by 14 million tons compared to 2017 (37 percent), and the amount of water in 2020 was expected decrease by 22 billion m³ compared to 2019 (a decrease of 157 billion m³ compared to 2011).20

![Figure 10: Environmental impacts on cropland degradation in 2019](Source: Agriculture, Forestry and Fisheries Census in 2020)

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The decline in water resources of the Mekong River has disrupted production activities in the watershed area and exacerbated saltwater intrusion in coastal areas. The results of the census of Agriculture, Forestry and Fisheries in 2020 show that about 30 percent of agricultural households in the MD have degraded arable land. Of these, most of the environmental impacts on cropland are saline intrusion, drought and water shortage.

**Excessive sand and groundwater extraction**

Increasing sand mining activities on the river to serve the demand for construction materials cause the landslide situation to increase in the MD. The decline in alluvium content, sand mining activities and unplanned infrastructure construction contribute to increasing negative impacts. From 2010 to 2018, the landslides happened very quickly and became increasingly complicated, with a total of 562 points (786 km long), of which the riverbank was 513 points (520 km long) and the coast was 49 points (266 km long). Landslides have greatly affected the infrastructure (transportation, domestic water supply system) and people’s houses, causing not only material losses but also in losses in terms of life and wellbeing, and at the same time, created waves of migration for livelihoods.

In addition, over the past 30 years, the population of the MD has increased rapidly, the speed of urbanization and industrialization has accelerated, agricultural production has shifted to intensive farming and there is the cultivation of three rice crops/year with the systems of dikes, sluices and dams to control salinity and encroachment on forests for aquaculture development. The population spread and gradually shifted to be arranged close to canals and rivers. Along with that, the growth trend in groundwater extraction for domestic use and agricultural production is partly due to the limited access to clean water from surface water sources due to pollution from agricultural and industrial production. The strengthening of underground wells in turn causes another consequence of land subsidence.
Flood control activities and agricultural production of people are unsustainable

The expansion of year-round flood control zones, increased cropping and unsustainable farming practices in the MD have left some alarming consequences in terms of ecology, environment, biodiversity and efficiency of resource use, increasing the vulnerability of the MD to climate change and upstream development activities.

Nearly 50 percent of medium flooded areas and 30 percent of deep flooded ones which have been controlled for autumn-winter crop production by the dike system is the main reason for reducing the flood water storage capacity of the MD to just over half, as compared to the previous period (from 5-7 billion m³ to 3-4 billion m³). This increases the risk of saltwater intrusion downstream and the area of land affected by drought and salinity.

Agricultural intensification also reduces soil fertility and increases the risk of pests and diseases in the MD, which in turn leads to excessive use of fertilizers and pesticides. Wastewater, and waste products from livestock, aquaculture and cultivation are not treated thoroughly. The system of dikes and sluices to prevent salinity began to affect the natural flow and self-cleaning mechanisms of the river system. These reasons have contributed to the pollution of surface water, which makes the disease situation, especially in aquaculture, difficult to control, increasing production costs and risks for producers.

When the soil is increasingly degraded related to less alluvium accretion, farmers have to use more fertilizers, which increases production costs and continues to aggravate soil degradation and environmental pollution. The pollution due to overuse of chemical fertilizers and pesticides also contributes to the destruction of natural ecosystems and reduces the biodiversity of coastal waters. As a result, farmers’ incomes from wild fishing are reduced or even altogether lost.

Irrigation system

The massive development of irrigation systems (dikes) for rice intensification over the past decades has had many negative impacts on the storage and distribution of
water resources in the MD. In the upstream area, especially Dong Thap Muoi and Long Xuyen Quadrangle, the dike systems (closed dike and mezzanine dike) and flood drainage channels to the Western Sea have prevented flood water from entering deeply in the field. The policy of flood drainage in order to fully exploit the land for agricultural production causes the land to be increasingly depleted. To ensure productivity, farmers are forced to add a large quantity of chemical fertilizers. This affects the quality of arable land when fertilizing for a long time.

The closed dyke system in the upstream provinces of the MD increases the water level of the river systems during the flood season, causing dyke breakage and flooding in adjacent areas (which have not been protected by dyke systems) and downstream areas. The uneven distribution of water resources makes it difficult for farmers to arrange a seasonal schedule (rice) and manage irrigation for crops that do not require much water, including citrus trees (oranges, tangerines and so on) in flooded areas.

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Status of production and market access

Production scale and income from agriculture

Currently, more than 90 percent of farming households in the MD have less than two hectares of arable land. However, if only two rice crops are grown, even in a good season free from disasters and epidemics, farmers can only profit about VND 30 million/year with each hectare. If a farmer household has five people, the average income per capita from rice cultivation is only about VND 6 million/person/year. This is the reason why farmers, even if they try to cultivate one more rice crop, are still poor. This show that the MD has been the region with the highest contribution to agricultural products, but its economic role has been decreasing compared to other regions in the country for many years. The total income and contributions of the MD to GDP over the past three decades have plummeted as a result of the policy of focusing most of its production capacity on the mission of protecting and maintaining food security for the whole country.23

Table 1: Structure of households using agricultural land by land size in 2020

<table>
<thead>
<tr>
<th>Region</th>
<th>Number of agricultural households</th>
<th>Percentage of households by cultivated area</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>&lt;0.2 ha</td>
</tr>
<tr>
<td>Country</td>
<td>8,162,851</td>
<td>42.67</td>
</tr>
<tr>
<td>Red River Delta</td>
<td>1,364,209</td>
<td>72.25</td>
</tr>
<tr>
<td>Midlands and Northern Mountains</td>
<td>1,752,674</td>
<td>41.63</td>
</tr>
<tr>
<td>North Central and Central Coast</td>
<td>1,927,092</td>
<td>47.78</td>
</tr>
<tr>
<td>Highlands</td>
<td>1,014,357</td>
<td>9.02</td>
</tr>
<tr>
<td>Southeast</td>
<td>466,983</td>
<td>14.85</td>
</tr>
<tr>
<td>Mekong Delta</td>
<td>1,637,536</td>
<td>20.16</td>
</tr>
</tbody>
</table>

Source: Midterm survey results on agriculture and rural areas in 2020

Also, while the MD region has 75 percent of the population living in rural areas and has many advantages in developing agro-forestry-fishery, the income from them accounts for only about 22 percent of the monthly total income per capita. According to

the General Statistics Office, the majority of people’s income comes from wages (41 percent) and from non-agricultural activities (24 percent). The average per capita income of the MD is VND 3.9 million/month, lower than the national average income (VND 4.2 million/month). It is noteworthy that only three localities in the MD have incomes slightly above the national average, including Can Tho - the central city of the region, Tien Giang and Long An - the two provinces closest to HCMC with the advantage of industrial development.

![Figure 11: The income per capita of provinces in the MD and in the whole country in 2019](source)

**Producing by quantity**

Although gradually applying science and technology in agricultural production, most farmers in the MD still maintain traditional farming methods. Farmers are still prioritizing production quantity instead of focusing on improving the quality and value of agricultural products. This forms production practices that are deeply ingrained and difficult to change among most rice farmers. Traditional production methods greatly affect the quality of rice grains and reduce profits as investment expenditures for production (labor, fertilizer, pesticides and so on) always increase over the years.
Therefore, the issue that needs attention now is determining how to organize and link a large number of farmers into production chains through cooperatives or cooperative groups. Through these representative organizations, they can directly participate with businesses in building and expanding raw material areas in order to increase the quality and value of agricultural products, expand markets and consume agricultural products.

**Table 2: Barriers restricting high agricultural development in the Mekong Delta**

<table>
<thead>
<tr>
<th>Intrinsic weaknesses from the farm household</th>
<th>Ratio (%)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Lack of land, limited in-field irrigation system</td>
<td>Yes</td>
<td>73</td>
</tr>
<tr>
<td>2. Lack of capital and lack of access to finance</td>
<td>Yes</td>
<td>91</td>
</tr>
<tr>
<td>3. The source of labor in the family is small and it is difficult to hire labor from outside</td>
<td>Yes</td>
<td>32</td>
</tr>
<tr>
<td>4. Lack of forecast information on agricultural market</td>
<td>Yes</td>
<td>24</td>
</tr>
<tr>
<td>5. Having enough experience and knowledge to apply new technology</td>
<td>Yes</td>
<td>17</td>
</tr>
<tr>
<td>6. Having conditions for cooperation and support from the community and society</td>
<td>Yes</td>
<td>11</td>
</tr>
<tr>
<td>7. Ability to understand policies from the State</td>
<td>Yes</td>
<td>18</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>External challenges impacts</th>
<th>Yes</th>
<th>Uncertain</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>8. The State has not yet regulated – forecasted the market well</td>
<td>Yes</td>
<td>80</td>
<td>Uncertain</td>
</tr>
<tr>
<td>9. Environmental pollution (soil and water), adverse weather</td>
<td>Yes</td>
<td>75</td>
<td>Uncertain</td>
</tr>
<tr>
<td>10. Poor competitiveness by value of agricultural products</td>
<td>Yes</td>
<td>81</td>
<td>Uncertain</td>
</tr>
<tr>
<td>11. Slow innovation in land policies</td>
<td>Yes</td>
<td>24</td>
<td>Uncertain</td>
</tr>
<tr>
<td>12. Difficult receiving funding from the State and banks</td>
<td>Yes</td>
<td>16</td>
<td>Uncertain</td>
</tr>
<tr>
<td>13. Agricultural services are relatively well supported</td>
<td>Yes</td>
<td>22</td>
<td>Uncertain</td>
</tr>
<tr>
<td>14. Useful technical training and agricultural extension to farmers</td>
<td>Yes</td>
<td>17</td>
<td>Uncertain</td>
</tr>
<tr>
<td>15. Receiving support from projects of NGOs, CSOs</td>
<td>Yes</td>
<td>07</td>
<td>Uncertain</td>
</tr>
</tbody>
</table>

*Source: Le Anh Tuan, 2020.*

*Note: The rate estimates in the table are preliminary only from informal interviews in the MD provinces (Number of survey n = 146 people are middle farmers, having at least 0.5 ha or more for cultivation)*
A survey by Le Anh Tuan (2020)\textsuperscript{24} revealed that in rural conditions and based on the current situation of farmers, the application of high-tech/smart agriculture is very limited due to many weaknesses in the households themselves or external factors, such as policies, markets and natural conditions. According to the results of small surveys, assessing the high level of agricultural adoption (only partially, not necessarily smart agriculture) is carried out at three levels of scale: (i) the rate of yes: when accounting for more than two thirds of random survey cases agree; (ii) uncertain rate (average): about $\frac{1}{2}$ selected cases; and (iii) the rate of no: when about one third of the respondents recorded more negative factors than positive ones.

\textbf{Lack of linkage in production}

Over the past decade, the issue of regional connectivity in the MD has been mentioned by many levels of government, local leaders and scientists. The Prime Minister (2016) promulgated Decision 593/QD-TTg on the pilot Regulation on linking socio-economic development in the MD in the period of 2016–2020. The latest is the promulgation of Resolution No. 57/NQ-CP dated April 21, 2022, of the Government of

\textsuperscript{24} Le Anh Tuan (2020). \textit{Climate change and livelihoods of people in the Mekong Delta}. Paper presented at the Workshop “Climate change and livelihoods of people in the Mekong Delta”.

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Viet Nam (2022), which identifies tasks and solutions to improve institutional linkages between socio-economic regions. Specifically, the goal of Resolution 57/NQ-CP is to perfect the institution of regional linkage in the 2021-2030 period in order to strengthen the central government’s role in coordinating regional linkages and promote government linkage in the region. At the same time, perfecting the institution of regional linkage in order to harmoniously combine the development of the local economy with the regional economy on the basis of effectively promoting the potentials and strengths of each region and each locality.

However, the regional linkage has not currently progressed because there are still many problems in terms of mechanisms and finance, and it is difficult to share the budget among different localities and sectors. Many provinces have not yet clearly seen the global benefits in regional linkages and no organization has yet been able to take on the role of coordinator or arbitrator in the linkage. In production linkages between enterprises and farmers, the agreements are not legally binding; commitments to share benefits and risks are still quite general and easily broken when there are big fluctuations in the market.

**Restrictions in access to export markets for agricultural products**

The MD is quite diverse in agricultural products, including fruit trees, industrial plants, freshwater and saltwater aquatic products, and so on. In recent years, the agricultural product market has expanded and increased sales in export markets. However, the quantity of exports has increased, but the value has not increased accordingly due to the low quality. The main reasons are: (i) agricultural production is mainly small-scale, fragmented and spontaneous; (ii) agricultural products are not uniform in terms of standards due to the fact that the production process of clean and safe quality has not been properly followed, and the product designs are not in accordance with the standards; and (iii) there is a lack of flexibility in choosing export markets and there is too much dependence on some old and easier markets like China.

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In recent years, the source of agricultural products in the MD has begun to decline in value, and the average income per hectare is not high due to slow improvement of quality and limited export market. In the coming years, the negative impacts of climate change, sea level rise, industrial development and the operation of hydropower projects and water transfer in the upstream areas will cause production capacity and other livelihoods be more seriously affected (Le Anh Tuan, 2012\textsuperscript{26}; To Quang Toan \textit{et al.}, 2014\textsuperscript{27}).


III. MODELS IN AGRICULTURAL TRANSFORMATION IN THE MEKONG DELTA
1. Goals of agricultural transformation in the Mekong Delta

*Modernizing agriculture and increasing the quality of agricultural products*

Increasing income in a stable and sustainable way for farmers is the primary goal of agricultural transformation in the MD. In the strategy of pushing the region towards sustainable development, in addition to advocating for appropriate governance reforms, farmers must adapt to the changes with the co-support of social organizations, scientists, and businesses.

The problem of rural job creation requires farmers to participate in production activities as not only are they pure agricultural producers, but also, they must gradually become entrepreneurs. In addition, they need to actively participate in other production activities, know how to grasp the market, increase the value of agricultural products and adapt well to adverse external developments.

*Developing the agricultural economy according to the market mechanism*

Modernizing agriculture in the MD in order to increase the value and quality of agricultural products is urgently needed. High-tech agriculture plays a particularly important role in increasing the mechanization and automation of the stages of the agricultural production process, and application of biotechnology related to plant varieties and livestock. It helps to ensure high economic efficiency per unit area and assists with developing sustainably on the basis of organic farming and minimizing adverse impacts on the environment.

Developing agriculture in association with the operating mechanism of the market creates conditions for farmers and businesses to grasp market demand, thereby investing and developing high-value agricultural products. In this context, there should be cooperation between farmers and enterprises (under the four-house mechanism) to support each other in identifying markets and organizing production to meet those needs. Here, the State plays a very important role in creating an open legal environment and mechanism, creating motivation for farmers and investing in expanding the production of enterprises. It can be seen that operating an agriculture economy under the market mechanism requires the effective support of four houses and the responsibilities of the parties.
Developing sustainable agriculture according to the “circular” model

Circular Economy or “favorable nature” are both sustainable development models based on the goal of utilizing waste sources and minimizing environmental pollution, maintaining the long-term use of raw materials and regenerating natural ecosystems (MacArthur Foundation, 2019). For the agricultural industry, the concept of a Circular Economy is understood as the utilization of nutrients from different farming systems, minimizing input sources and limiting environmental pollution. In addition, the Circular Economy is also geared towards the utilization of waste by-products, recycling and reuse, and finally, treatment and utilization of output sources (converting waste into bio-fertilizers, food and renewable energy) (MacArthur Foundation, 2019; Toop et al., 2017).

For the Vietnamese agricultural industry, the application of Circular Economy principles will bring many benefits in terms of improving production efficiency, value chains and product quality, creating product channels and new jobs, as well as reducing environmental pollution.

2. Vision of Regional Integrated Planning for Agriculture

Resolution 120

General assessment of the MD

+ Changes at the global level: Climate change and sea level rise are happening faster than forecasted, causing many extreme weather events and affecting people’s livelihoods and lives;

+ Changes at the regional level: The exploitation of water resources upstream of the delta, especially the construction of hydroelectric dams, has changed the flow, reduced the amount of silt, decreased fishery resources, and caused saltwater intrusion deep into the region, negatively affecting the region’s socio-economic development; and

+ Changes at the local level: The negative side of intense economic development activities in the region is becoming increasingly acute, causing many consequences such as environmental pollution, severe ecological imbalance, land subsidence, groundwater level decline, and coastal encroachment. Furthermore, many areas of natural forests, especially mangroves, melaleuca forests and protection forests have been cut down,
converted for other uses or severely degraded. In addition, the excessive exploitation of mud and sand by building houses and infrastructure close to the banks of rivers and canals increases the risk of landslides.

It can be seen that changes at the regional and local levels have far-reaching effects on the agricultural sector in the MD, both in the short- and long-term. Among them, at the regional level, changes in flow, reduction of alluvium, decline in aquatic resources and saltwater intrusion deep into the region are most important. At the local level, overexploitation of sand and groundwater, environmental pollution and ecological imbalance are the main causes.

**Conclusion of Resolution 120 relating to agriculture**

The important points in Resolution 120, from actively changing the thinking and understanding of agriculture to specific orientations, planning and objectives, immediate priority and up to 2100, include:

* a) The MD development model must be human-centered, taking water resources as a core factor and a basis for policy making. In regional development planning, brackish water and salt water should be considered as natural resources for economic development;

* b) Shifting from a purely agricultural production mindset to a diversified agricultural economic development one, from quantitative to high quality development;

* c) The transformation of agricultural development model must be based on the ecosystem, ensuring conformity with natural conditions, biodiversity, culture, people and other natural laws;

* d) Forming ecological sub-regions as orientations for agricultural economic development and infrastructure (flooded plains, freshwater ecological zones, brackish and salt water ecological zones); and

* e) Building the structure of agricultural production according to three focuses: fisheries – fruit trees – rice associated with ecological sub- regions, in which aquatic products (fresh water, brackish water, salt water) are considered as the main products.
Integrated planning

In the report “Master Plan for the Mekong Delta in the 2021-2030 period, with a vision to 2050”, announced by the Ministry of Planning and Investment in 2020, the fields related to agriculture are listed, analyzed and numbered in statistics data, including:

- **Agriculture**: Rice, fruits, vegetables and livestock
- **Forest**: Mangrove forest and Melaleuca forest
- **Fisheries**: Aquatic raising and fishing (in land and at sea)

Thus, the word “agriculture” is often interpreted differently. In NQ120 it includes “rice, aquaculture and fruit trees”. Comparatively, in Decree 98/2018/ND-CP, the definition of agriculture includes cultivation, animal husbandry, fisheries, forestry and salt production.

In all these three documents (NQ120, Decree-Government 2018 and Mekong Delta Master Plan), it is clear that the quantitative components of agriculture have not been fully listed, completely without qualitative components as services of agro-ecosystems to humans and natural environment.

3. Implement agricultural transformation in the Mekong Delta

In order to transform agricultural models adapting to climate change smoothly and effectively, it is necessary to make progress in the following areas:

**Change vision**

The MD is currently facing many challenges such as an economic decline, a lack of stability, lack of social progression and environmental degradation. In addition, the transboundary threats are increasing due to the operation of a chain of hydroelectric dams on the upper Mekong River; negative impacts of climate change and sea level rise on agricultural production, especially rice plants; the problem of unsustainable

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resource exploitation in the delta’s interior, causing subsidence and landslides;\textsuperscript{30} and the impacts of intensive production on the environment.\textsuperscript{31} All of these demonstrate the need for a change in the development vision in the MD, especially in agricultural transformation to strengthen all three pillars: society, economy and environment.

A change in the view of agricultural production according to the economic-agribusiness model to ensure food security needs and increase value for agricultural products is extremely necessary.\textsuperscript{32} With that spirit, Resolution 120 has identified three pillars of agricultural production in the MD in order of priority: fisheries - fruits - rice. This helps to readjust the structure of agricultural development in ecological regions. Thereby, agriculture in the MD expands production scale in the direction of increasing the value of agricultural products, and ensures the domestic and export agricultural supply markets, increasing income for farmers.

From the point of view of adaptation, there have been a number of agricultural transformation activities in the MD, starting from adaptation, increasing to system adaptation and finally, transitioning adaptation. This adaptation usually happens in the following way: from the single inventions of a few farmers, then with the support of scientists and NGOs, these models are gradually completed and expanded. Approaching ecosystem–based farming production models helps farmers better adapt and be more flexible to the negative impacts of climate change, reducing their vulnerability and enhancing their resilience in changing conditions.


Realizing the agricultural transformation vision in the MD requires the implementation of a combination of solutions, such as: (i) scientific–engineering solutions and adaptive farming systems; (ii) small work solutions to reduce investment costs and flexible management; (iii) suitable conversion of land use purposes; and (iv) investments in larger works to manage risks and accept some sacrifices of environmental and ecological factors. This is entirely favorable, reducing violent interference with nature and avoiding the possibility of regret later due to its uncertain factors.

**Transform production models**

In fact, some farmers in the MD have shifted to forms of agricultural production in the direction of increasing the value of agricultural products. Previously, farmers only knew how to produce and sell to traders or companies. This relationship is uncommitted and unsustainable, making it easy for farmers to lose out when there are adverse changes in weather, market and policies. Currently, farmers have the support of the OCOP programme.

Agricultural products are processed into goods and services that are developed

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based on the comparative advantages of each locality, have added value and have positive impacts on the local community. Products labeled OCOP can register an exclusive trademark, thereby increasing competition in the market. Market information, consumer reflection and updated weather factors help farmers make farming decisions for each of their seasons.

![Figure 13: OCOP Model](image)

*Source: Le Anh Tuan, 2021.*

Farmers participating in this model help increase the value of agricultural products as well as increase income, generate jobs for laborers in the community, promote the development of craft villages, preserve indigenous culture, promote tourism activities, and so on. At the same time, market-oriented forms of agricultural farming are increasingly being popularized. Large enterprises can call on farmers to grow rice, fish, and shrimp together, creating large fields. In addition, the enterprises also support technical transfer and mechanization for production, product consumption, processing, packaging, promotion and distribution.

This model allows farmers to become more deeply involved in the value chain of agricultural products, taking the initiative in capital and technology for the transition. This model of production - processing - supply chain is being applied by a number of large corporations such as Vinamit, Vinamilk, and My Lan, and operates stably.
Transform institution

Strengthen responsibility and link four houses

For a long time, the linkage of four houses (State, entrepreneurs, scientists and farmers) has played an important role in Viet Nam’s agriculture in general and the MD in particular. That is also the inevitable trend of a modern agriculture, where the four families find a common voice. However, the past time shows that this relationship is not close; the responsibility of the houses in the production relationship is still loosely defined, and there is a lack of necessary support for farmers to participate in the construction and completion of agricultural value chains and increase income.

Therefore, it is necessary to rebuild the support mechanism, ensuring the mutual responsibility between the actors. In particular, it is necessary to build an institutional framework to ensure compliance with the implementation of regulations between businesses and farmers to ensure benefits among the parties. Scientists have the role of providing technical support, directly connecting with farmers in technology transfer and providing expert advice to farmers in the production process. The State grasps the reality, thereby building institutional and legal frameworks to ensure the enforcement of regulations and equality among the parties, especially in the relationship between enterprises and farmers.

The coordination among the actors in the four-house linkage helps to remove the institutional problems that govern the production, purchasing and processing of agricultural products, and to solve the “rescue” problem that is common in the MD due to not being able to find a market for export. If this relationship is strengthened, farmers will actively decide to invest in production because they know that their products will have a profit or consumption market. This is the way to ensure the sustainable development of agriculture in the MD in particular, and the whole country in general.

Increase budget spending and promote public investment

The MD should also be prioritized for more budget allocation, commensurate with the population size, contribution level, challenges as well as socio-economic development requirements of the region, in which it is necessary to invest in agricultural modernization and support the transition to suit the new situation.
Accordingly, the proportion of budget allocated to the region must increase to at least 18 percent of the total budget expenditure of localities (i.e., according to the proportion of population size). If calculated according to the budget expenditure per capita, the current expenditure of VND 7.6 million is also the lowest average level, so it needs to be raised to approximately VND 9 million, equivalent to other economic regions with similar development levels.

In budget allocation for the MD, increasing investment capital for infrastructure, especially transport infrastructure, is very important. This stems from the fact that the quality of transport and logistics infrastructure in the MD is among the lowest in the country. The target of allocating public investment capital to the region in the period of 2021-2025 is about VND 388,000 billion. Of this, VND 266,000 billion allocated through the local budget should be arranged and disbursed in a timely manner to ensure the effective promotion of investment capital. The bottlenecks in the implementation of public investment plans, site clearance, disbursement of investment capital, and so on, need to be promptly removed by localities in the region, in order to speed up the progress and promote the economic efficiency of the project.
Public investment capital managed through ministries and branches, especially the Ministry of Transport, the Ministry of Agriculture and Rural Development and the Ministry of Health should also be promoted by the Government, especially to key transport infrastructure projects, which are the lifeblood of regional connectivity. In addition, the search for foreign funding for the missing part of the Government’s $2 billion plan for the MD should also be promoted as soon as possible in the context of the increasing challenges of climate change, which are fast and complex.

**Transform Science – Technology**

*Promote high-tech agriculture*

Promoting high-tech agriculture is a key factor in the implementation of agricultural transformation in the MD. This is a production method applying high technology (such as: mechanization, automation, computerization and so on); environmentally friendly green production technology; reduced consumption of natural resources; and reduced greenhouse gas emissions. Coming to this approach, all agricultural products are preserved cleanly and processed according to safety standards, increasing the value of agricultural products with quality recognition.

Implementing mechanization and modernization of agriculture requires the combination of actors in the four-house linkage. In addition, there should be support from donors (such as NGOs and civil society organizations) and banks (supporting lending, credit, incentive programs and so on). In agricultural production, it is necessary to integrate six sectors: mechanization-automatic; meteorology-hydrology; biotechnology, chemistry; preservation and processing of agricultural products; finance, business administration and information technology.

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The development and application of the internet with cloud technology has created a smart farming model. In particular, the sensor system measures soil nutrients for fertilizing in order to properly use according to the needs of plants and soil, instead of estimating, as was done previously. This system, when integrated with weather and climate parameters, creates a model of smart agriculture to respond to climate change (climate-smart agriculture - CSA).

With this model, algorithms are designed to help farmers make optimal choices from analyzing rainfall, humidity, radiation, temperature and light according to soil parameters, growth stage and nutritional needs of plants and animals to make rational decisions. My Lan Group is a good example of applying the CSA model in agricultural production, increasing the value of agricultural products.

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**Extend farmers’ production models and initiatives**

Successful production models of farmers play an important role in the implementation of agricultural transformation in the MD. There are farmers who have many initiatives in production, increasing household income and contributing to local socio-economic development policies. They invented machinery and equipment for production (for example, a plant protection sprayer in An Giang), which saves time, financial resources, and effort, and improves production efficiency. They are considered “innovators”, always finding new solutions to meet practical needs in the production process.

Therefore, in addition to honoring the contributions of farmers, localities need to promote the replication of these models/initiatives to improve economic efficiency. It is necessary to link farmers with businesses in the process of implementing production models to standardize products. This association helps farmers continue to research, improve and perfect production models to optimize product quality to better meet market demand.

**Improve the quality of the agricultural extension team**
Agricultural extension agencies play a particularly important role in supporting farmers in the production stage. Agricultural extension officers are those who directly work with farmers, always closely monitoring and monitoring the production situation in the locality. They provide information and transfer technical solutions to help farmers better understand and make better decisions in the production process.

However, the reality shows that the qualifications of agricultural extension workers are still low, and they do not have much experience in practice. In addition, this force is still lacking in some localities, so it has not yet fully and synchronously supported farmers in the production process. In the context of modernizing the MD’s agriculture, the role and responsibility of agricultural extension need to be paid more attention. In particular, it is necessary to focus on improving capacity and strengthening support for farmers to participate in supply chains from production, distribution and consumption of agricultural products to help farmers achieve the highest profits.

4. Typical agricultural transformation models

*Loc Troi*

The model of Loc Troi group is a typical example of the linkage between farmers and agriculture. Through working together directly with farmers, they support and transfer technology to them to increase productivity, reduce costs, and thereby, increase income. Specifically, in production activities, Loc Troi has applied biotechnology to process waste products and by-products such as rice straw to make organic fertilizer right in the field. On the other hand, Loc Troi also develops biological products to improve the efficiency of fertilizer use, contributing to increased yields. In addition, Loc Troi also strengthens supervision and inspection to ensure the quality and safety of products, helping products to meet demanding markets and customers, thereby improving economic efficiency for the entire value chain. The fact that enterprises directly link with farmers, strengthen quality control and transfer advanced production technology is a sustainable model, contributing towards a circular economy. This both increases people’s income and reduces negative impacts of production activities on the environment.

Besides the above model, the rice-shrimp-crab rotational farming model is also bringing value and high income to farmers in brackish water areas where saltwater
intrusion is frequent in the dry season. Research by Truong Hoang Minh\textsuperscript{36} shows that the application of natural rice - shrimp model with stocking density of two to three shrimp/m\textsuperscript{2} of water surface brings a high profit margin (340 percent) and income (19 million/hectare/4-month crop).

Another study by Le Canh Dung\textsuperscript{37} also showed that the profit of the rice-shrimp model can be up to 40 million/hectare/crop if the stocking density is up to eight to nine shrimp/m\textsuperscript{2} of water surface and industrial feed is added. This author also shows that households that combine rice farming with shrimp farming are 1.4 times more productive than those who do not grow rice and shrimp thanks to the nutrition from rice straw left behind by the rice crop. On the other hand, the cost of fertilizer for rice also decreased by an average of 30 percent because the waste from the previous shrimp crop fertilized the soil and the cost of using chemical drugs also decreased because people

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\textsuperscript{36} Truong Hoang Minh, Tran Hoang Tuan and Tran Trong Tan 2013, Comparison of production efficiency of two models of black tiger shrimp – rotational rice, traditional and improved in Kien Giang province, Can Tho University Journal of Science. Issue 28b (2013), pp.143 - 150

were afraid of affecting the next shrimp crop.\textsuperscript{38} It can be seen that the model of shrimp-rice combined with crab is a sustainable model in the direction of a circular economy that brings high income to people in coastal brackish water areas, adapting to the increasing saltwater intrusion due to the depletion of water resources upstream.

\textit{My Lan}

My Lan Group and Rynan Agrifoods Company in Tra Vinh province are an example of a unit that uses the association of scientists-businesses-the State-farmers through the introduction of high-tech applications in agriculture, smart farming and computing technologies into the production decision-making process that increase the value of agricultural commodities and products. The Group’s achievements include:

- Slow-release fertilizers provide nutrients for plants throughout the entire process from seeding to harvesting, with a particularly intelligent release mechanism, reducing usage by 40-60 percent, applying fertilizer only once for each crop, increasing harvest yields by more than 10 percent, and reducing greenhouse gas emissions by more than 60 percent.

- The system monitors salinity and river characteristics to automatically decide on the irrigation process for rice under the “Alternative Wet and Dry” (AWD) method to save water, energy and labor. Additionally, the product reduces greenhouse gas emissions by more than 40 percent and increases the ability to cope with climate change-related impacts such as saltwater intrusion and water shortage for cultivation.

- Increase the value of rice, processed shrimp, packaging and vending system.

\textit{Vinh Hoan}

Since 2008, Vinh Hoan company has successfully built the program “Green farm”. Vinh Hoan’s business model is based on the core principles of sustainable practice and environmental responsibility, as the key to long-term industry development. Vinh Hoan has a closed pangasius farming and production process, which businesses can control from seed - farming - harvesting - processing - production - marketing - sales. Thanks to the application of science and technology, Vinh Hoan does not discard any part of the

\textsuperscript{38} Nguyen Cong Thanh, Le Xuan Sinh, Nguyen Van Hao and Dang Thi Phuong, 2011, Analysis of risks and limitations of the rice-shrimp rotation model being applied on the Ca Mau Peninsula.
pangasius fish, including the skin, fat and viscera, which were previously considered waste products. In addition to fish fillet products, they use fat to produce fish oil, skin for deep-fried fish skin, collagen and gelatin, fish bubbles and stomachs for frozen food.

*Viet Nam Food*

Viet Nam Food Joint Stock Company (VNF) has turned the “by-products” of the shrimp industry into valuable products, proving that by-products are valuable assets, not burdens. The project “Completing and mastering the biotechnological process” aims to treat shrimp by-products in a zero-waste approach with an input capacity of 100 tons/day, achieving recovery efficiency from 50 percent to at least 80 percent, serving the pharmaceutical, food and agricultural industries. VNF and its partners have studied the use of enzymes to recover protein in shrimp carcasses and shells; application of recycling technology to reuse wastewater in the production of high-quality chitin through biochemical methods; extracting chitosan base from chitin and low molecular weight chitosan from finely ground shrimp carcasses and shells during the production of SSE/Hydrolyzed Protein Fluid; and using biotechnology to produce waste sludge materials as microbial fertilizers from sewage sludge.
**Ecodota Ecological Agricultural Farm**

From the fact that mango waste causes serious pollution in the largest mango production area of the MD, the owner of the Ecodota Ecological Agricultural Farm has experimented with black soldier flies. This is both to treat organic waste from mango production and to use black soldier fly larvae as food for chicken, duck, and fish farms, and also as inputs for hydrolyzed fluid and microbial organic fertilizer products.

Black soldier flies are harmless and non-infectious organisms. Their food is mainly from vegetables, tubers, fruits and leftovers. The life cycle of black soldier flies only last about 40 days, and black soldier fly larvae are also food for raising aquatic products such as shrimp, crabs, fish, eels and frogs. Every day, Ecodota farm processes 6-10 tons of waste from mangoes, and the amount of larvae produced is enough to supply 2,000 chickens, saving 20 to 30 percent of breeding costs. Moreover, black soldier fly larvae are also processed into hydrolyzed fluid for processing animal and aquaculture feeds. Also, the excrement of the black soldier fly larvae is used to produce microbial fertilizer to re-fertilize the mango orchards, helping to reduce the amount of chemical fertilizers used and improve the degraded soil quality.

![The life cycle of the black soldier fly](source: MAY3A.com)

**Figure 15: The life cycle of the black soldier fly**
IV CONCLUSION AND REQUESTS
Conclusion

In general, agricultural production in the MD is simultaneously affected by climate change, extreme weather, and rising water; hydroelectricity exploitation, increases in water volume for agricultural production activities in the upper Mekong River; over-exploitation of groundwater and sand on the riverbed; flood control activities and unsustainable agricultural practices.

In addition, there are existing issues due to environmental pollution, especially water pollution in rivers and canals; indiscriminate use of plant protection drugs; developing industry and craft villages without planning; hygiene and safety of agricultural products.

Besides the natural factors, the MD’s agriculture is also facing many other problems, such as that the scale of agricultural production is still small, fragmented and with low added value. Exported products are mainly raw, low-value, and unsustainable. Renovating the form of production organization in agriculture is still taking place slowly, mainly in the household economy; the majority of enterprises and cooperatives are small in scale, with limited operational efficiency.

Moreover, the MD’s agriculture has not shifted in the direction of a modern agriculture, associated with the market economy and international integration. Production planning is still subjective and has not properly forecasted market demand. The connection between agricultural production and processing industry and farmers, entrepreneurs and scientists is still weak leading to low-value, risky and unsustainable production. Many agricultural products, especially raw ones, are too dependent on certain markets. The paradox of “good season, bad price” is often repeated. The application and transfer of techniques and technologies to agriculture still face many difficulties.

These factors act simultaneously and exacerbate one another, adversely impacting the MD’s agriculture and becoming increasingly serious. Currently, although localities still have policies to develop and respond to climate change, these models need to be perfected to be effective. Implementing agricultural transformation needs to focus on the role of farmers in linkage with the State (policy support), scientists (technical assistance) and entrepreneurs (market support). It is necessary to promote close
coordination and linkage among actors to improve the value, competitiveness and position of Vietnamese agricultural products in the international market. In doing so, the income and quality of life of farmers are improved. This is one of the most important tasks in the process of agricultural transformation in the MD in the coming time.

**Recommendations**

Agricultural transformation models need to focus on the value of agricultural products and food safety, based on natural and environmental factors in the spirit of “favorable nature”. This reduces environmental consequences and results in greater economic, environmental and social performance. In addition to some typical agricultural orientations and models, this Research Report also proposes some specific solutions towards sustainable agriculture, as follows:

- The development of a convenient and flexible land use conversion mechanism that has some preferential policies on land, income tax and interest.

- Planning for regional linkages and creating opportunities for enterprises/cooperatives to produce and do business in the direction of chain linkage as the circular economy model.

- Investing in infrastructure for electricity, water, transportation and information technology to support and attract investments in agricultural projects on climate change adaptation.

- Attracting talent and retaining a young workforce to develop the MD. Training human resources to serve the transition to high-tech agriculture.

- Co-ordinating with the Mekong Delta Resilient Business Network to provide information on climate change for businesses, as well as update and support the application of climate change adaptation production methods.

- Participating in and supporting the implementation of the Annual Economic Report Mekong Delta in order to conduct in-depth research and assessments on climate change adaptation in the region to have a basis for promoting appropriate policies towards the sustainable development of the MD.

- Actively integrating information on risks of saltwater intrusion and drought into agricultural, forestry and fishery development plans in ecological sub-regions.
- Building and operating a system of environmental monitoring, warming for irrigation water in estuaries and canals to monitor saline intrusion and salinity level to inform people and cooperatives.

- Organizing and engaging farmers in production chains through cooperatives. This is an appropriate model in the context of small farming areas and the lack of investment resources in the MD.

- Supporting cooperatives and farmer households to develop models of circular economy on agriculture and ecological agriculture in rice and fruit production, animal husbandry and aquaculture.

- Building large-scale agricultural production areas associated with the application of science and technology to adapt to climate change, applying innovative and creative solutions to improve product quality and support deep processing.
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Vietnam Chamber of Commerce and Industry branch in Can Tho
12 Hoa Binh, An Cu Ward, Ninh Kieu District, Can Tho City
02923 824 918
vpvccicantho@vccimekong.com.vn
vccimekong.com.vn